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ABSTRACT

A case study of a 2-year-old progressing normally in speech development provides evidence of suprasegmental marking of the plural, thought to be adopted only in language-impaired children. Acoustic analyses of the durations and intensity of elicited words indicate that the child had adopted a suprasegmental strategy for marking the singular/plural distinction. Factors that appear to contribute to this marking system include constraints on children's phonetic and phonological capabilities, the importance of number marking in children's morphological systems, the psycholinguistic motivation to increase phonetic output to signal plural, and the iconic quality of markedness, associating increased magnitude of suprasegmental parameters with a greater number of objects. (MSE)

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ICONICITY IN SEMANTICS: A CASE OF SUPRASEGMENTAL MARKING IN THE ACQUISITION OF THE ENGLISH PLURAL

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In earlier papers, we presented case studies of language-impaired children who had adopted suprasegmental strategies for marking the plural (cf. Camarata & Gandour, 1985; Camarata & Erwin, in press). Because these children were suffering from impaired phonological systems, they could not produce the usual segmental form of the marker (e.g., [s, z, əz]). We argued that the suprasegmental strategy of increasing duration, intensity, and frequency was highly idiosyncratic, and to be candid, we felt it unlikely that such cases would appear elsewhere. Additionally, these case studies were offered in support of those theories of language acquisition which view the child as an active learner as they gain linguistic competence (Kiparsky & Menn, 1977; Macken & Ferguson, 1983).

However, if the parameters surrounding such suprasegmental marking are examined in more detail, it is evident that many normal children face precisely the same kinds of phonological constraints found within these earlier case studies. For example, fricatives are acquired rather late, and final clusters are acquired very late (Ingram, 1981). However, crosslinguistic studies demonstrate the importance of the plural because it is acquired early universally (Slobin, 1970). Thus, the constraints for suprasegmental marking of plural in language impaired children should be problematic for language normal children as well because they also would have the early motivation for signaling plural in the absence of a developed phonological system.

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The purpose of this paper is to present yet another case study involving suprasegmental marking of plural that differs from the previous papers in one important aspect: the child described herein is not language impaired. Rather, she is progressing normally. In addition to presenting the specific acoustic-phonetic structure of this suprasegmental marking, it will be argued that such marking is perhaps a rather common phase in the acquisition process resulting from the iconic aspects of child language acquisition (cf. Slobin, 1985).

Case Profile

The subject of this investigation, KM, was 2:7 (years:months) at the time of data collection. She is from a monolingual English speaking home and achieved developmental milestones within the normal range according to parental report. The results of the Denver Developmental Scale verified these reports as KM was within normal limits on both the cognitive and motor portions of this assessment instrument.

Morphological Analysis

In terms of linguistic development, results of standard language sampling procedures and scoring derived from Brown's (1973) procedures indicated that she acquiring the language in a typical fashion as well. The Mean Length of Utterance (MLU) from a 150 utterance language sample was 2.2; well within the normal range presented in Miller's (1981) normative data. This MLU placed KM in Brown's stage II, when present progressive, on, and plural often appear in a child's speech. Both present progressive and on were used within the sample; indeed these were the only grammatical morphemes evident within her linguistic system. However, the adult version of the plural was absent from the sample.

Phonological Analysis

A phonological analysis suggested that a lack of development within the segmental domain was a likely source for the difficulty in plural production. Like many children, KM could not produce final fricatives with any degree of consistency and no final clusters were evident within her speech. To be sure, KM's phonological system was much richer than those of the children described in the earlier reports (Camarata & Gandour, 1985; Camarata & Erwin, in press) as she produced stops with a high degree of accuracy and was in the process of learning the fricatives. However, like these earlier cases, she did have full control of the segments needed to produce plural. Thus, the basic convergence of phonological and morphological factors resulting in suprasegmental marking in the earlier reports were evident here as well.

Method

The methodology developed by Camarata and Gandour (1985) for the elicitation and analysis of children's plural productions were adopted within the present investigation. In addition, the elicitations and subsequent acoustic analyses were performed by a research assistant who was blind to the purpose and theoretical underpinnings of the study. The language sampling session and subsequent word elicitation session were completed within a quiet room in

KM's home and audio recorded in stereo using a Marantz PMD 420 cassette recorder and two Realistic 33-1056A electret microphones attached to KM's shirt approximately 10cm below her mouth.

Word Elicitation

The procedures employed by Camarata and Gandour (1985) were once again used here. Because it was important to avoid specific cuing of the singular-plural distinction, a naming task was utilized in order to ensure representative productions. KM's original language sample and diary information provided by her parents were examined to determine which nouns she had acquired. This list of nouns was further analyzed to determine which included only single syllable word structures.

A randomized list of singular and plural versions of these words was then constructed such that no singular and plural forms of the same word appeared contiguously. Pictures of these singular and plural nouns were then presented in the following manner. The research assistant presented the picture without any verbal prompt whatsoever. Often, KM would spontaneously name the picture following this presentation. If she did not produce the word spontaneously, the research assistant asked her to: "Name the picture." This verbal prompt was used for both singular and plural versions of the targets in order to avoid experimenter bias intruding upon the child's productions. If KM did not produce the word following this prompt, the investigator went on to the next picture. At not time was the target word produced by the research assistant and thus, no imitative productions were included in the acoustic analyses. A total of 13 singular/plural word pairs were obtained within the elicitation session.

Acoustic Analyses

A Kay 6095/6097 visipitch-Apple IIe interface coupled to a Sony TC-FX220 cassette deck was used for the acoustic analyses. The acoustic parameters of interest included duration; peak, mean, and delta fundamental frequency (F_0); and peak, mean and delta intensity. Duration was measured using the procedures suggested by Peterson and Lehiste (1960) by determining elapsed time from the onset to the offset of the vowel nucleus. Initial and final consonants were not included as the voice onset of these can vary widely at this age (cf. Leonard et al. 1985). The F_0 and intensity measures were completed over the duration described above. The peak and mean values were simply derived from the online video display provided by the visipitch and entered directly into the computer. The delta values were calculated by subtracting the onset F_0 (or intensity) from the offset F_0 (or intensity). The standard

error of measure for these procedures were as follows: 2.1 msec for duration; 1.0 Hz, 1.1 Hz, and 2.3 Hz for peak, mean, and delta F_0, respectively; and 0.5 dB, 0.6 dB, and 2.7 dB for peak, mean, and delta intensity respectively.

Results

The results of the acoustic analyses are presented in Table 1. The means and standard deviations of the selected acoustic parameters are greater consistently in the plural productions. That is, plural were productions were an average of 148.2 msec longer in duration, 29.9 Hz higher in peak F_0, 10 Hz higher in mean F_0, 35.9 Hz greater in terms of delta F_0, 0.9 dB higher in peak intensity, 0.2 higher in mean intensity, and 1.7 greater in terms of delta intensity.

A series of one way analyses of variance (ANOVA) for repeated measures (Winer, 1971) were applied to the data to test the observed differences. These statistical analyses indicated that many of the aforementioned differences were indeed significant. Duration ($F = 30.47$; $df = 1, 12$; $p < 0.05$), peak F_0 ($F = 18.58$, $df = 1, 12$; $p < 0.05$), mean F_0 ($F = 11.29$; $df = 1, 12$; $p < 0.05$), delta F_0 ($F = 16.16$; $df = 1, 12$; $p < 0.05$), and delta intensity ($F = 5.54$; $df = 1, 12$; $p < 0.05$) were all greater in the plural form of KM's productions. Neither peak intensity ($F = 1.25$; $df = 1, 12$; $p > 0.05$) nor mean intensity ($F = 0.59$; $df = 1, 12$; $p > 0.05$) were significantly different.

TABLE 1. Means and standard deviations of selected acoustic parameters for singular and plural productions.

	Singular		Plural	
	Mean	SD	Mean	SD
Duration*	257.2	84.3	407.0	113.8
Peak F_0*	264.5	22.4	294.4	25.8
Mean F_0*	233.9	13.2	243.9	11.8
Δ F_0*	56.9	26.5	92.8	37.7
Peak Intensity	48.5	3.3	49.4	3.6
Mean Intensity	46.0	2.2	46.2	2.7
Δ Intensity*	6.2	3.2	7.9	3.0

* denotes significant difference ($p < 0.05$) between singular and plural productions on these parameters.

Discussion

The above analyses indicate clearly that KM had adopted a suprasegmental strategy for marking the singular/plural distinction. This strategy bears a remarkable similarity to those adopted by the language impaired children described within Camarata and Gandour (1985) and within Camarata and Erwin (in press). Because this production now appears to be more widespread than it was originally thought to be (cf. Camarata and Gandour, 1985), the fundamental linguistic nature and phonetic origins of this marking system bear closer analysis. The following morphologic, phonologic, and psycholinguistic factors appear to all contribute to this marking system.

Phonetic Constraints

The shift to suprasegmental marking is phonetically and phonologically reasonable. As noted earlier, segmental control of the phones needed to mark plural emerges relatively late (Ingram, 1976). However, suprasegmental control emerges relatively early in phonological development (Crystal, 1973, 1979). From a phonological perspective, suprasegmental phonemic contrasts are not uncommon in languages of the world. For example, rising versus falling intonation is contrastive in Thai. Similarly, rising (as opposed to falling) intonation is used in English to mark questions (Crystal, 1979). Indeed, young children acquire this intonational form of question marking long before they acquire the syntactic means of signaling questions (Crystal, 1979). Interestingly, a similar pattern of marking was noted by Lord (1974), who indicated that rising versus falling intonation was contrastive for negative marking in the young child she examined. It is clear that a suprasegmental pattern of marking plural is very much in keeping with children's phonetic and phonological capabilities and may indeed a likely form in the early development of this morpheme.

Morphological Constraints

Hockett (1958) reports that number marking is a linguistic universal, indicating the importance of producing the singular-plural distinction within a linguistic system. Evidence of the importance of marking the plural in language acquisition can be seen in the cross-linguistic acquisition data: the plural morpheme is acquired relatively early in most languages (Slobin, 1970). Additionally, the sequence of morphological acquisition in English demonstrates further the relative importance of producing the plural morpheme: The plural is produced earlier than both the possessive and third person singular morphemes (Brown, 1973; James & Kahn, 1982) despite identical phonological structure for all three morphemes.

Beyond this, the plural acquisition also reflects young children's preference for object marking (Slobin, 1979). The plural form is earliest acquired morphological marker involving objects. The importance of this marker can be seen in the fact that possessive, which also involves objects and an identical morphological structure, is acquired much later than plural (Miller, 1981). Clearly, the plural is an important morphological marker in children's linguistic systems and therefore likely to undergo alternative phonological marking.

Psycholinguistic Motivation

Slobin (1979) presents data which indicate an increase in phonetic output is used to signal the plural in many languages. These data, in part serve as the basis for Slobin's language acquisition universal 3: "The closer a grammatical system adheres to one-to-one mapping between semantic elements and surface elements, the earlier it will be acquired (p. 109)." The direction of change, an increase in these suprasegmental parameters, may reflect an increase in the number of objects. The results of this investigation and that of Camarata and Gandour (1985) and Camarata and Erwin (in press) are consistent with this hypothesis: All children within these studies used an increase in the phonetic output to signal plural.

Iconic Aspects of the Marker

In a more recent paper, Slobin (1985) proposes that children are linguistic icon makers: signally perceptual aspects of the language within the actual linguistic structure. For example he notes that negatives are rarely bound morphemes because such elements are not inherent characteristics of the objects and actions whereas possessive are almost exclusively bound morphemes as this marker is included in the noun concept. The results of this investigation and those of Camarata and Gandour (1985) and Camarata and Erwin (in press) are consistent with this hypothesis. Indeed, the plural marker observed here is iconic in the extreme: more objects was associated with an increased magnitude of the suprasegmental parameters. Additionally, the marker appeared as a bound morpheme, again consistent with Slobin's (1985) analysis. Thus, the results of the current investigation can be viewed as strong evidence in favor of the notion that children act as linguistic icon makers.

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